PLOW CUTTING EDGE

Inventors: Jayson D. Jones; Jeff J. Smith

Cross-Reference to Related Applications

This application claims priority under 35 USC §119(e) to U.S. Provisional Patent Application 60/453,619 filed 11 March 2003, the entirety of which is incorporated by reference herein.

Field of the Invention

This document concerns an invention relating generally to plowing blades, and more specifically to the cutting edge of a plowing blade (at which the blade rides along the surface being plowed).

Background of the Invention

Plowing action in a snowplow (or other type of plow) is generally effected by the plowing vehicle's moldboard, the (usually curved) shovel-like blade situated in front of the plowing vehicle. At the lower edge of the moldboard, a sacrificial cutting edge is usually provided – a strip of hardened steel, generally carbide steel, which is bolted to the bottom of the moldboard and which is intended to bear the brunt of the wear (rather than the moldboard itself) as the cutting edge scrapes along the roadway. Exemplary cutting edges can be seen, for example, in U.S. Patents 3,477,149; 3,888,027; and 4,590,694. In some cases, cutting edges may take forms other than blades, e.g., they may assume wedge or block shapes, as in U.S. Patents 1,543,222; 5,471,770; and 5,611,157; or they may assume the form of flexible teeth, as in U.S. Patents 5,140,763 and 5,819,443; or the form of a flexible strip, as in U.S. Patent 2,061,585.

Because such cutting edges wear quickly – they may require replacement in no more than about 100 hours of plowing – there is a significant desire in the road machinery industry to develop ways to reduce cutting edge wear and replacement cost/time. Cutting edges are sometimes protected against impact damage by hinging them to the bottom of the moldboard and then biasing them with springs (as in U.S. Patent 5,437,113), elastic elements (as in U.S. Patents 4,347,677; 4,288,932; 5,743,032; 6,125,559; and 6,269,556, as well as in UK Patent GB1058602; Soviet patent SU751891; and French patent FR1243526), or a combination of these (as in German publication DE3205973A1) to remain in their operative position until an object (such as a curb) is struck, in which case the cutting edge will temporarily fold back, to return when the load is relieved. However, these "trip" cutting edge arrangements merely protect against impact damage; ordinary wear from scraping against the roadway is not relieved. Apart from generating undesirable costs from the standpoint of the material cost of blade replacement, the need to replace a worn cutting edge also generates significant costs in terms of lost usage of plowing vehicles, and time lost by plowing personnel to maintenance rather than to plowing operations. In the snowplowing field, where the economic cost of unplowed roads (and the resulting delays in transportation and commerce) can be very significant, lost time is a critical concern. One approach that is often taken is to provide replaceable "teeth" or inserts, often made of specially-chosen materials, at the bottom of the cutting edge so that the teeth can be replaced as they wear. See, e.g., U.S. Patents 3,529,677; 3,934,654; 4,715,450; 4,770,253; 5,224,555; 5,778,572; 5,813,474; 5,881,480; 6,003,617; and 6,202,327. While these often allow a cutting edge to last longer, they may nevertheless exacerbate disadvantages in replacement costs and maintenance time.

A hybrid approach is presented by U.S. Patent 5,746,017 to *Marvik*, wherein the cutting edge is segmented into a number of individual "shares," and the shares are then embedded side-by-side in an elastomeric mass which is in turn bolted to the lower edge of the moldboard. In effect, the shares resemble a series of "teeth" protruding from an

elastomeric "gum" at the bottom of the moldboard. As the shares scrape along the ground, their elastomeric mounting allows each to slightly give when road irregularities are encountered. According to distributors of this type of cutting edge - which is sometimes referred to as the JOMA cutting edge - good snow and ice removal is obtained, and at the same time the shares experience less wear. Wear on the roadway is also reduced, which is an important consideration owing to the cost of replacing scraped-away markings on the roadway, etc. Another advantage reported by users of this type of cutting edge is that the cutting edge transmits substantially less road vibration to the frame and cab of the plowing vehicle, which also results in decreased vehicle wear and maintenance (and is also far less taxing on the plowing vehicle's operator during plowing operations).

However, a significant disadvantage of the JOMA cutting edge is its cost: the expense of generating the multi-part segments or "shares," and embedding them within an elastomer mount, is significantly greater than the cost of a standard one-piece, all metal cutting edge. Replacement costs can also be effectively exacerbated since when the cutting edge loses one of its "teeth" (shares), the entire length requires replacement for effective cleaning of the surface being plowed. Therefore, it would be useful to have available other cutting edges which obtain results at least comparable to the JOMA, at lesser cost.

Summary of the Invention

The invention involves a cutting edge which is intended to at least partially solve the aforementioned problems. To give the reader a basic understanding of some of the advantageous features of the invention, following is a brief summary of preferred versions of the cutting edge. As this is merely a summary, it should be understood that more details regarding the preferred versions may be found in the Detailed Description set forth

elsewhere in this document. The claims set forth at the end of this document then define the various versions of the invention in which exclusive rights are secured.

A plow moldboard cutting edge includes a cutting edge blade having a front (leading) face and a rear (trailing) face, with one or more receiving apertures defined therebetween. An elastic bushing is then provided in each of the receiving apertures of the cutting edge blade, with each bushing having a through hole defined therein. The cutting edge blade is then fastened to the lower edge of a plow moldboard by extending fasteners through cutting edge mounting holes defined in the plow moldboard adjacent its lower edge, and then into the through holes of the bushings. The fasteners secure the bushings to the plow moldboard, and thereby mount the cutting edge blade (which is situated about the elastic bushings) to the plow moldboard as well, with the elastic bushings elastically spacing the cutting edge blade from the fasteners. As a result, when the cutting edge blade is driven along a roadway or other surface to be plowed, the elastic bushings elastically suspend the cutting edge blade from the moldboard so that the cutting edge blade rides along the plowing surface and better conforms to the plowing surface's contour. The elastic bushings additionally help to avoid shock transmission between the cutting edge blade and moldboard, and assist in reducing wear on the cutting edge blade.

If the elastic bushings and/or fasteners do not by themselves retain the cutting edge blade on the plow moldboard, a mounting member (e.g., an elongated bar or other member sized to maintain each elastic bushing within its receiving aperture) may be situated adjacent the cutting edge blade so that the cutting edge blade is situated between the mounting member and the moldboard. The mounting member may include fastening holes defined therein so that the fasteners extend through all of the mounting member, the receiving apertures of the cutting edge blade (and the through holes of the elastic bushings therein), and the plow moldboard.

The elastic bushings preferably include nonelastic (e.g., metal) bushings lining their through holes, so that the through holes of the nonelastic bushings effectively define

the through holes of the elastic bushings. The lengths of the nonelastic bushings (as measured along the axes of their through holes) are preferably greater than the thicknesses of the elastic bushings (as measured in the same dimension) so that the nonelastic bushings help hold the moldboard and any mounting member in spaced relationship, and maintain some small amount of space between these components and the elastic bushings. The elastic bushings may therefore elastically displace during plowing operations without being held against the moldboard (and/or any mounting member), so that they do not bind or rapidly wear.

Further advantages, features, and objects of the invention will be apparent from the following detailed description of the invention in conjunction with the associated drawings.

Brief Description of the Drawings

FIG. 1 is a front exploded perspective view of an exemplary version of the invention.

FIG. 2 is a front perspective view of the assembled invention of **FIG. 1**.

Detailed Description of Preferred Embodiments of the Invention

A preferred version of the invention is depicted in the accompanying drawings. Referring initially to the exploded assembly view of **FIG. 1**, a moldboard **200** has a lower edge **202** along which are spaced a number of cutting edge mounting holes **204**. A cutting edge **100** then includes:

(1) A cutting edge blade **102**, which is generally similar to a standard cutting edge save that it has a number of receiving apertures **104** defined along its length, each receiving aperture **104** being generally coaxial with one of the cutting edge mounting holes **204** on the lower edge **202** of the moldboard **200**;

(2) A number of elastic bushings **106**, each of which has an outer diameter sized to be closely received within one of the receiving apertures **104**, and an inner diameter lined with a metal bushing **108** with a through hole **110** sized similarly to a cutting edge mounting hole **204**; and

(3) A mounting member **112**, shown in **FIGS. 1** and **2** in the exemplary form of a plate, which has a number of mounting member fastening holes **114** spaced thereon, each fastening hole **114** being generally coaxial with one of the cutting edge mounting holes **204** (and one of the bushing through holes **110** when the elastic bushings **106** are installed in the receiving apertures **104**).

During assembly, the elastic bushings **106** are each fit within a receiving aperture **104** within the cutting edge blade **102**. The cutting edge blade **102** is then situated against the moldboard **200**, and the mounting member **112** is then situated atop the cutting edge blade **102** so that fasteners (shown only in **FIG. 2** at **116**) can be extended through the mounting member fastening holes **114**, the bushing through holes **110**, and then through the cutting edge mounting holes **204**, so that the arrangement appears as depicted in **FIG. 2**.

As a result of the foregoing arrangement, the cutting edge blade **102** is sandwiched between the moldboard **200** and the mounting member **112**, which are maintained in spaced relationship by the metal bushings **108** (but held together by the fasteners **116**). However, the cutting edge blade **102** is elastically suspended from the moldboard **200** and the mounting member **112** by the elastic bushings **106**, allowing the cutting edge blade **102** to elastically displace along a plane between the moldboard **200** and the mounting member **112**. It is also preferred that the metal bushings **108** have lengths (as measured along their axes) slightly longer than the axial lengths (or thicknesses) of the elastic bushings **106** (which preferably have the same thickness as the cutting edge blade **102**). For example, the metal bushings **108** may have 13/16" lengths and the elastic bushings **106** may have axial lengths (thicknesses) of 3/4", so that the metal bushings **108** each

extend axially outwardly by 1/16" from the elastic bushings **106** (e.g., 1/32" on each side of the elastic bushings **106**). As a result, when the metal bushings **108** are each sandwiched between the mounting member **112** and the moldboard **200**, the elastic bushings **106** and the cutting edge blade **102** have 1/16" of "play" between the mounting member **112** and the moldboard **200**.

As a result of the foregoing arrangement, when the cutting edge **100** is scraped along the ground, the cutting edge blade **102** may deflect along its plane (i.e., radially about the bushings **106** and **108**), as well as slightly forwardly or backwardly (i.e., it may rotate out of its plane by a small amount). Transmission of road vibrations is greatly decreased, and additionally the life of the cutting edge blade **102** is greatly increased. Where the cutting edge blade **102** is made of carbide steel, it has been found that wear is no longer of the catastrophic mode experienced when the blade is simply bolted to the moldboard – the blade does not chip away in pieces – and rather it more slowly wears away abrasively. Since the entire cutting edge **100** involves no additional assembly steps above that of ordinary cutting edges, save for the insertion of the elastic bushings **106** within the receiving apertures **104**, assembly/disassembly time is not disadvantageously increased over standard arrangements. Additionally, the arrangement is far less expensive to manufacture than prior competing arrangements.

The description set out above is merely of one exemplary preferred version of the invention, and it is contemplated that numerous additions and modifications can be made. Following are additional examples.

First, the elastic bushings **106** need not be circular/cylindrical in shape, and may take other forms; and while the interior metal bushing **108** is preferred, it is not necessary. Thus, as an example, the elastic bushings **106** might simply take the form of elastomeric cubes each having a through hole **110** drilled through it, with each cube fitting within a complementary receiving aperture **104** in the cutting edge blade **102**.

Second, the mounting member **112** need not be formed as a plate. As an example, the mounting member **112** might instead be provided as a large washer, with each of the bushings **106** having such a washer-like mounting member **112** adjacently situated with a fastener **116** extending through the mounting member **112**, the bushing **106**, and the moldboard **200** so that each such mounting member **112** (which is preferably sized larger than the receiving aperture **104** of its adjacent bushing **106**) holds the cutting edge blade **102** adjacent the moldboard **200**, and holds its adjacent bushing **106** within its receiving aperture **104**. Further, the mounting member **112** is not essential, and other arrangements might be used to maintain the bushings **106/108** (and the cutting edge blade **102**) against the moldboard **200**. As an example, each of the elastic bushings **106** might be provided with its own radially-extending lip at one axial end, with the lip preventing its elastic bushing **106** from passing entirely through its receiving aperture **104**. Each elastic bushing **106** can then simply be fastened within its receiving aperture **104**, with the cutting edge blade **102** being sandwiched between the moldboard **200** and the lip of the elastic bushing **106**.

Third, the cutting edge blade **102** can be segmented into multiple "teeth," as exemplified by the proposed separation lines shown (in phantom) along the cutting edge blade **102** in **FIG. 1**.

The invention is not intended to be limited to the preferred versions of the invention described above, but rather is intended to be limited only by the claims set out below. Thus, the invention encompasses all different versions that fall literally or equivalently within the scope of these claims.